

REMARKS

Claims 1-23 are pending in the present application. Claims 24-46 have been withdrawn from consideration. By virtue of this response, Claims 1, 4, 11 and 15 are amended. Accordingly, Claims 1-23 are currently under consideration. Amendment of certain claims is not to be construed as a dedication to the public of any of the subject matter of the claims as previously presented. No new matter has been added.

Rejections

Claim 1 is rejected under 35 U.S.C. §102(b) as anticipated by Gallagher et al (U.S. patent 5,640,343).

Claim 11 is rejected under 35 U.S.C. §102(b) as anticipated by Gallagher et al (U.S. patent 5,640,343).

Claims 2-10 are rejected under 35 U.S.C. §103(a) as being unpatentable over Gallagher in view of Yagishita et al (U.S. Publication 2002/0179980).

Claims 12-23 are rejected under 35 U.S.C. §103(a) as being unpatentable over Gallagher in view of Yagishita et al (U.S. Publication 2002/0179980).

Amendments

Each of Claims 1 and 11 are amended here. The amendments are supported by, for instance, page 26, lines 4-7 of the specification indicating "...since the resistance value varies when a voltage is applied, it can be used as memory means by replacing the resistance values before and after it varies with a signal."

Claims Distinguish Over Gallagher

It is respectfully submitted that the claims as amended distinguish over Gallagher. Gallagher discloses use of an MTJ (magnetic tunnel junction) which the Examiner reads on the present "variable resistive element". In Gallagher's MTJ approach, the storage of the data depends

on the change of direction of magnetization by applying an electric field. Gallagher is in fact disclosed in the present application in the Related Art section beginning page 2, line 21 and carrying over to page 4, line 4.

As indicated in the present specification at page 3, beginning line 19, there are deficiencies to the Gallagher approach. See line 21 "...there is a problem in that high-temperature heating process cannot be adopted when the diode is formed. As a result...it is difficult to constitute a large-scale memory array." Hence clearly Gallagher uses a different type of storage element than is disclosed and claimed in the present application. Unlike Gallagher, the present type of storage element is referred to as a variable resistive element and is a type of element which is programmed by application of one or more short electric pulses, for instance to a thin film material having a perovskite structure. As indicated in the present specification page 4, beginning line 23, in this type of variable resistive element "The material characteristics can be further changed by repeatedly applying the plural electric pulses to the above variable resistive element." Thus as pointed out at page 5, beginning line 10 "...the resistance value changes in a range of about one digit as the number of applied pulses is increased." Hence the various number of applied pulses change the resistance value and hence allows storage of information.

This is not the case with the Gallagher MTJ, which has only two states corresponding to the two magnetic states. In Gallagher, the information is not stored as in accordance with the present type of variable resistive element. For instance, the Examiner references Gallagher column 5, see especially column 5, lines 8-13 and 34-40. There is no indication here of the application of voltage pulses for programming. There is no indication of any particular electric resistance here either. Hence Gallagher, using the MTJ approach, does not rely on applied voltage pulses and does not have a true variable resistance. As pointed out in Gallagher column 2, lines 34-35, his is instead a magnetoresistive element. See also Gallagher column 2, line 42, saying "The resistance of the MTJ can be controlled without adjusting the shape of the MTJ element. Because resistance values greater than 500 Ohms are used in the memory cells, the power expended to sense the state of a memory cell can be much lower than in prior art memory cells. This value of resistance is achieved

in very small area MTJ elements by increasing the thickness or electrical barrier height of the tunneling barrier layer.” (Emphasis added.)

Hence while in Gallagher the resistance is at 500 ohms or greater, this is not a variable resistance due to programming by an applied voltage, but is the resistance in the memory cell as it is fabricated. Hence this is not a “variable resistive element” as recited in Claim 1 and the resistance in Gallagher is not “varied by applying a voltage to both ends of said variable resistive element” as recited in Claim 1. Furthermore, in Gallagher the variable resistance is not “stored as information by said variable resistive element” as further recited in amended Claim 1.

Hence clearly Gallagher does not meet Claim 1 since Gallagher uses a different type of memory element. Further, Gallagher does not make Claim 1 obvious since Gallagher instead teaches a significantly different type of storage element.

Claim 11 distinguishes over Gallagher for at least the same reasons as Claim 1, since Claim 11 recites “a variable resistive element which resistance value is varied by applying a voltage to both ends of said variable resistive element and is stored as information by said variable resistive element,”.

Claims 2-10 and 12-23, dependent respectively on Claims 1 and 11, distinguish over Gallagher for at least the same reason as does the base claim.

Claims 4 and 15 are Additionally Patentable

Claims 4 and 15, dependent respectively on Claims 1 and 11, are additionally patentable. These claims recite identically “said variable resistive element includes a resistive material having a perovskite-type crystalline structure.”

The Examiner rejected these claims citing Gallagher in combination with Yagishita stating, see Action page 3, “Yagishita discloses a semiconductor device...the resistive element (117) is a perovskite type crystalline structure,”. This rejection is traversed. Yagishita clearly does not have a perovskite type crystalline structure in a variable resistive element. In fact, Yagishita

does not disclose here any perovskite crystalline structure. See Yagishita paragraph 72 which describes structure 117, “After forming the Schottky junctioned source and drain, the process is similar to the usual LSI manufacturing process. That is,...the upper layer metal wiring (e.g. Al wiring) 117 is formed in the dual damascene method.” (Emphasis added.)

Thus Yagishita structure 117 is not a crystalline structure and is not a perovskite structure, but is aluminum wiring. Review of Yagishita does not indicate any relevant disclosure of perovskite crystalline structures and especially not in the context of a variable resistive element.

It is pointed out that in the present specification use of perovskite crystalline structures is described, see specification page 4, beginning line 15, “In U.S. Patent No. 6,204,139, there has been proposed a method in which one or more short electric pulses are applied to a thin film or a bulk formed of a thin film material having the perovskite structure, especially a colossal magneto resistive material and a high temperature super conductivity material, to change its electrical characteristics.”

However, Yagishita is not pertinent to the subject matter of Claims 4 and 15 at all.

Moreover it is noted that Yagishita is directed to the subject matter of a field effect transistor or MISFET, which does include a Schottky junction, but does not have the perovskite type crystalline structure, see Yagishita paragraph 3. Hence Yagishita clearly is not even in the field of variable resistive elements, but instead is a type of transistor, which is not a resistive type device.

Clearly then Claims 4 and 15 are not met by Yagishita even in combination with Gallagher, and hence the rejection is traversed and these claims are respectfully submitted to be patentable, even in the absence of patentability of base Claims 1 and 11.

Amendment Entitled to Entry

This Amendment is entitled to entry since it is filed together with an RCE.


CONCLUSION

In view of the above, all pending claims are believed to be in immediate condition for allowance. Accordingly, the Examiner is respectfully requested to withdraw the outstanding rejection of the claims and to pass this application to issue. If it is determined that a telephone conference would expedite the prosecution of this application, the Examiner is invited to telephone the undersigned at the number given below.

In the event the U.S. Patent and Trademark Office determines that an extension and/or other relief is required, Applicant petitions for any required relief including extensions of time and authorizes the Commissioner to charge the cost of such petitions and/or other fees due in connection with the filing of this document to Deposit Account No. 03-1952 referencing Attorney Docket No. 544782000300.

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Respectfully submitted,

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